Fluid flow and heat transfer over corrugated backward facing step channe

ABSTRACT

The convective heat transfer and flow field characteristics through a backward-facing step (BFS) channel combined with a corrugated wall is investigated numerically and experimentally. Uniform heat flux is applied on 200 mm of the downstream wall, while the rest of the walls are considered isolated surfaces. The range of Reynolds number (Re) of the flow was between 5000 and 20,000. The governing equations were solved using the RNG turbulent model. The effects of wavelength and amplitude height of the corrugated wall on the friction factor and Nusselt number are studied. The results indicated that the fluid flow in the BFS channel combined with the corrugated wall significantly enhanced the heat transfer with increased friction. The average increase in the heat transfer rate and friction factor in the experiment is 40.7% and 46.2% respectively. The simulation results are comparable to the experimental ones. According to the simulations, the channel with an amplitude height of 4 mm and a wavelength of 20 mm has the highest heat transfer enhancement, reaching a performance evaluation criterion factor of 1.33 at 5000 Re.

Keyword: Backward-facing step; Corrugation; Heat transfer; Turbulent flow